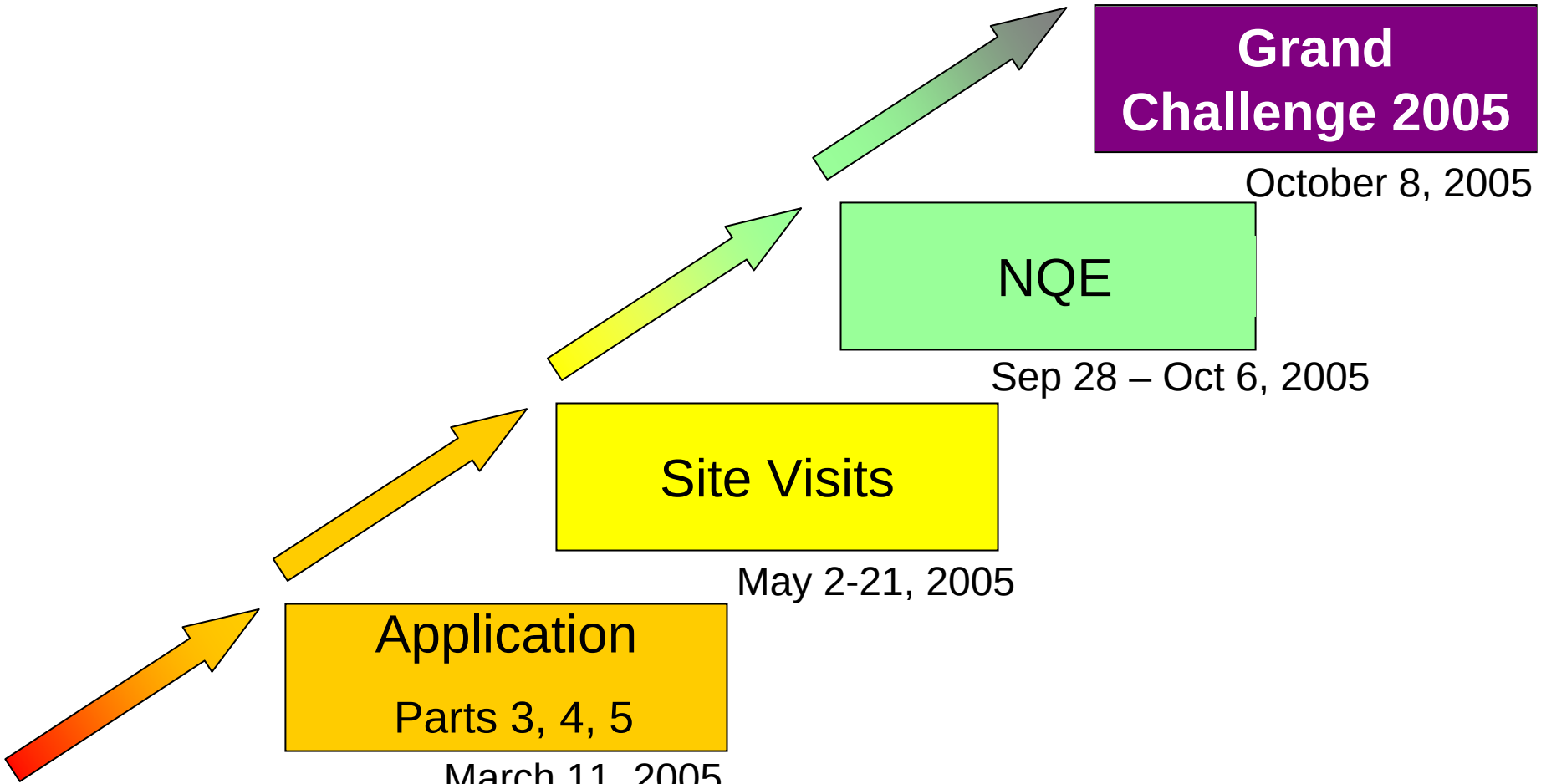
Qualification Process

Dr. Thomas M. Strat

Dr. Tom Strat

Grand Challenge 2005
Deputy Program Manager

Steps to Success…



As described in the Rules

Grand Challenge Qualification Process

Selection of the 20 vehicles most likely to complete the Grand Challenge route.

- Simple
- Fair
- Rigorous

Observe the Deadlines

Selection for Site Visits

Selection for Site Visits

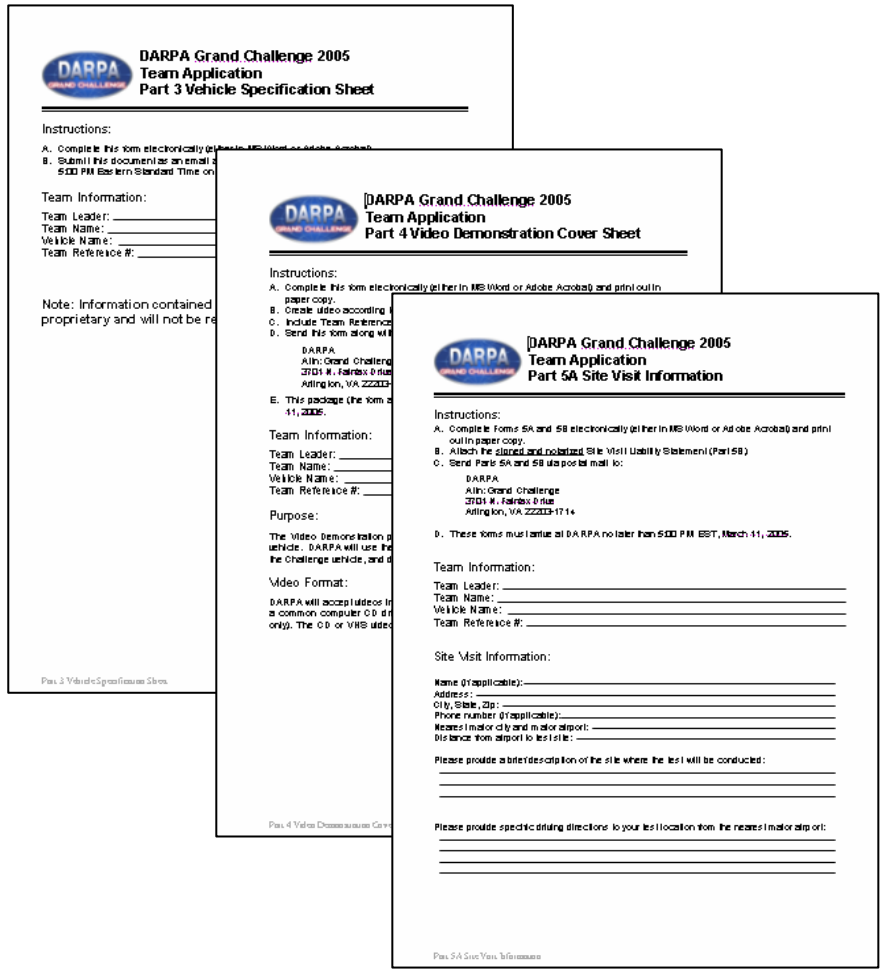
Part 3: Vehicle Specification

- Design complies with the rules

Part 4: Video Demonstration

- Level of integration

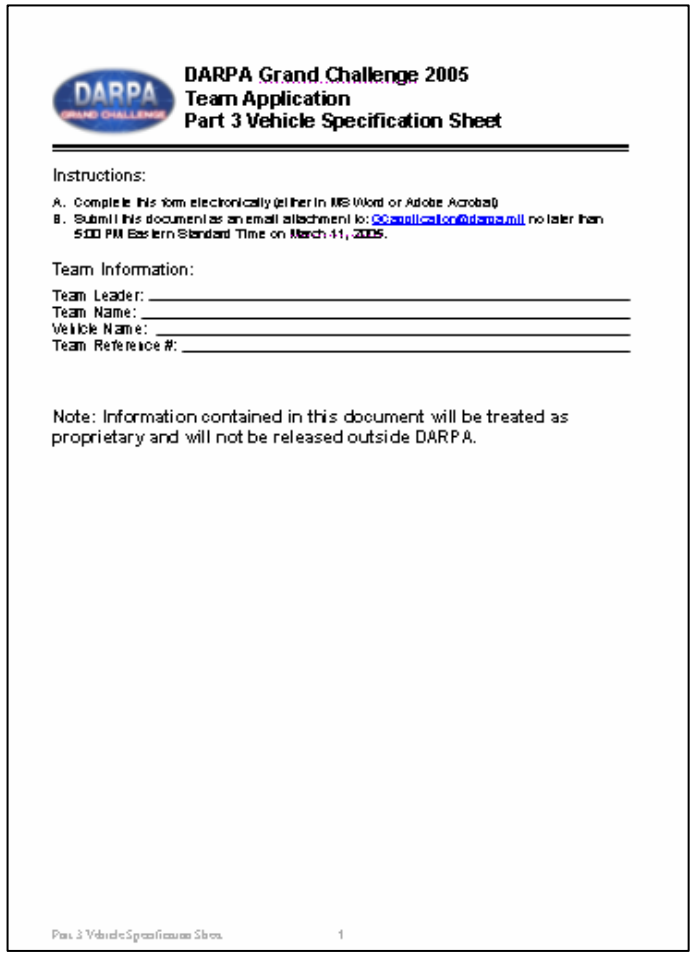
Part 5: Site Visit Information



Due: March 11, 2005

Part 3: Vehicle Specification Sheet

- Vehicle Description
  - Basic specifications
  - Photos or engineering drawings
- Localization
  - GPS / INS model and accuracy
- Perception
  - Sensors – type and purpose
- Speed
- System Tests



DARPA Grand Challenge 2005
Team Application
Part 3 Vehicle Specification Sheet

Instructions:

A. Complete this form electronically (either in MS Word or Adobe Acrobat)
B. Submit this document as an email attachment to: GCapplication@darpa.mil no later than 5:00 PM Eastern Standard Time on March 11, 2005.

Team Information:

Team Leader: _____
Team Name: _____
Vehicle Name: _____
Team Reference #: _____

Note: Information contained in this document will be treated as proprietary and will not be released outside DARPA.

Part 3 Vehicle Specification Sheet 1

Challenge Vehicle

Ground Vehicle

- Wheels, treads, legs…
- Roll, walk, hop, jump…
- No air vehicles and no air-cushion vehicles

Autonomous

- No remote-control, telemetry, or animals

Size

- Fit through underpasses 10-feet wide x 9-feet high
- Less than 20 tons

Localization

- Route corridor is 10-feet wide in some places
- GPS, GPS / WAAS are insufficient
- DGPS subscription services
- INS / IMU
- Recommend perception to stay on roads

Part 4: Video Demonstration

- Format
  - Digital file on CD, or
  - VHS tape
  - 5 minutes or less
- Show your Bot at its best
  - Static view of vehicle and subsystems
  - Vehicle in action, if possible

DARPA Grand Challenge 2005
Team Application
Part 4 Video Demonstration Cover Sheet

Instructions:

A. Complete this form electronically (either in MS Word or Adobe Acrobat) and print out in paper copy.
B. Create video according to format, outline, and content guidelines below.
C. Include Team Reference # on outside of the CD or videotape.
D. Send this form along with the video via postal mail to:

DARPA
Attn: Grand Challenge
3701 N. Fairfax Drive
Arlington, VA 22203-1714

E. This package (the form and video) must arrive at DARPA no later than 5:00 PM EST, March 11, 2005.

Team Information:

Team Leader: _____
Team Name: _____
Vehicle Name: _____
Team Reference #: _____

Use audio track to narrate your video

Video Demonstration

Sample Site Visit Video

Part 5: Site Visit Information

- Part 5A Site Visit Information
  - Basic details and directions to test location in United States
  - Team leader must be present at site visit
- Part 5B Site Visit Liability Statement
  - Safety is your responsibility
  - Must be notarized

DARPA Grand Challenge 2005
Team Application
Part 5A Site Visit Information

Instructions:

A. Complete Forms 5A and 5B electronically (either in MS Word or Adobe Acrobat) and print out in paper copy.
B. Attach the signed and notarized Site Vis
C. Send Parts 5A and 5B via postal mail to
DARPA
Attn: Grand Challenge
3701 N. Fairfax Drive
Arlington, VA 22203-1714
D. These forms must arrive at DARPA no l

Team Information:

Team Leader:
Team Name:
Vehicle Name:
Team Reference #:

Site Visit Information:

Name (if applicable):
Address:
City, State, Zip:
Phone number (if applicable):
Nearest major city and major airport:
Distance from airport to test site:
Please provide a brief description of the site
Please provide specific driving directions to

Part 5A Site Visit Information

DARPA Grand Challenge 2005
Team Application
Part 5B Site Visit Liability Statement

I, _____, as Team Leader representing Team _____, certify that I have identified a test location suitable for demonstrating my autonomous ground vehicle. This location and its features comply with all specifications outlined in the DARPA Site Visit Instructions (available at www.darpa.mil/grandchallenge).

This test location will be available to host a DARPA Grand Challenge Site Visit during the period from May 2 to May 21, 2005.

I assume complete responsibility for any and all activities that may take place at this test location during the entirety of the DARPA Grand Challenge Site Visit.

Further, I agree to be responsible for, to hold harmless, and to indemnify the U.S. Government, including the Defense Advanced Research Projects Agency (DARPA) and its employees, and those contractors and their employees acting on behalf of DARPA for the Grand Challenge 2005. This agreement to hold harmless and indemnify shall be for any and all claims of liability whether by reason of injury or death of any person, or of damage to the property of the Team, or another, arising from, or connected to the site visit.

I certify that the Team is authorized to use the premises as the test location for the purposes listed in the DARPA Site Visit Instructions. Further, any and all test location premises, test vehicle, and test activities are in compliance with federal, state, and local laws and regulations.

This signed and notarized certificate must be received by DARPA no later than 5:00 PM EST on March 11, 2005.

Team Leader Signature (in the presence of the Notary) Date

Printed Name

Team Name

Team Reference #

Notary Public

Date

Part 5B Site Visit Liability Statement

Selection for Site Visits

Part 3: Vehicle Specification
- Design complies with the rules

Part 4: Video Demonstration
- Level of integration

Part 5: Site Visit Information
- Location and liability

Due March 11, 2005

April 4, 2005: Notification for Site Visits

A Typical
Grand Challenge Site Visit

Site Visit Structure

- DARPA selects date and time
  - May 2-21, 2005
- Entrant selects location
  - Team leader
  - Citizenship document
  - Vehicle
- Two DARPA representatives
- 2-hour duration
  - 30-minute interview
  - 90-minute demonstration

Select 40 best teams for National Qualification Event

Interview Portion

- Vehicle Information
  - Navigation Subsystem
  - Perception Subsystem
  - Test and Integration
  - Innovative Elements
  - Team Resources

Dynamic Demonstration

- Show what your vehicle can do
  Safely and Legally!

- Autonomous operation

- Example
  - Large open area with good GPS coverage
  - Course with visible lateral boundaries
  - Waypoints
  - Left and right turns
  - Obstacle avoidance
    - Randomly placed obstacle
  - Multiple runs

Site Visit Summary

- Site Visits
  - May 2-21, 2005
- Location of your choice
  - In the United States
- 2 hours
- Interview
  - Tour of your vehicle
- Demonstration
  - Show what your vehicle can do

June 1: NQE Selection Announcement

National Qualification Event Prerequisites

- Documents (due August 15, 2005)
  - Technical Paper
  - Bailment Agreement
  - California Speedway liability agreement
- E-Stop

Technical Paper

- Information interchange
- Publishable quality
- Available for public release
  - Do not submit proprietary information
- Required for participation in NQE
  - Not for evaluation
- Will be published after completion of Grand Challenge 2005

DARPA Grand Challenge

Technical Paper for TerraMax

Submitted by Oshkosh Truck Co.
and
The Ohio State University

1. System Description
   a. Mobility.
      1. Describe the means of ground contact. Include a diagram showing the size and geometry of any wheels, tracks, legs, and/or other suspension components.

The vehicle platform is an Oshkosh Trucks MTVR ModelMK23. A brochure with technical specifications can be found at http://www.oshkoshtruck.com/pdf/Oshkosh_MTVR_brochure.pdf, which we also attach here. The minimum turning radius is 42.7 feet. However, if necessary, in "robot" mode (explained below) the vehicle will be able to turn a tighter corner in multiple back-forth motions. The vehicle can traverse a 60% grade and a 30% side slope. The vehicle cab and exhaust stack have been shortened to the dimensions given in section 3.f.2 to accommodate known requirements of the course.

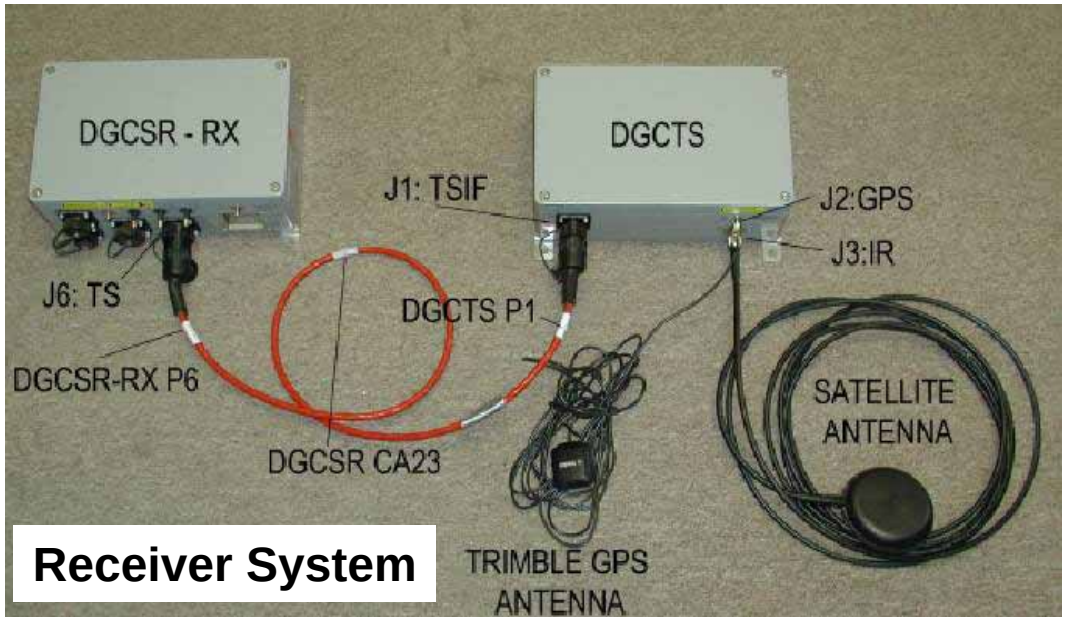
Figure 1. TerraMax arriving at the OSU Campus.

Due: August 15, 2005

Emergency Stop System

- DARPA will issue an E-stop system to all NQE participants (Semi-Finalists)
  - Equipment remains government property
- Teams must integrate an E-stop system
  - According to instructions
  - Prior to NQE
- E-stop modes
  - RUN – autonomous operation
  - PAUSE – controlled halt
  - DISABLE – shut down engine

E-Stop System



Receiver System

Transmitter

Size: 2 boxes each 10.25” L x 6.3” W x 4” H

Weight: About 20 pounds

Power:

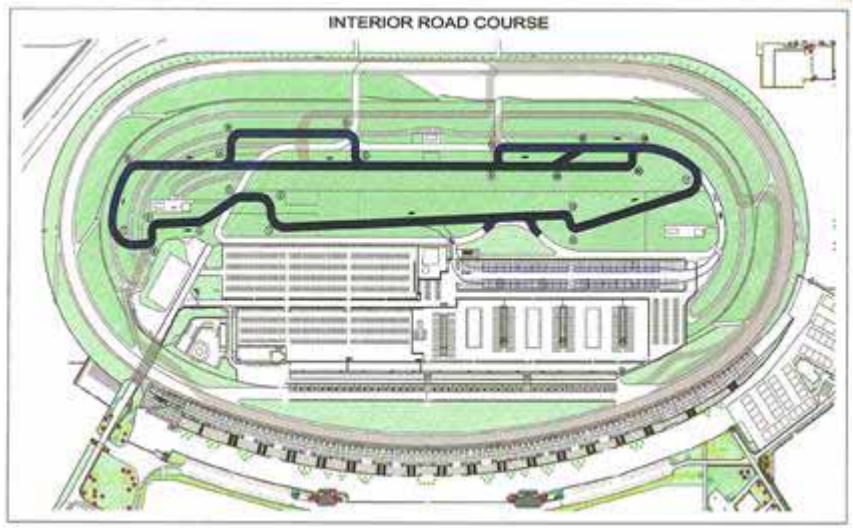
- E-Stop receiver requires a nominal 12 VDC power input
- Tracking system receives power from E-Stop receiver
- Combined power requirement is less than 50 W

National Qualification Event (NQE)

in association with:

National Qualification Event (NQE)

- September 28 – October 6, 2005
- California Speedway – Fontana, California
- Objective:
  - Test that each vehicle can be operated safely
  - Identify the 20 vehicles most likely to complete the Grand Challenge route

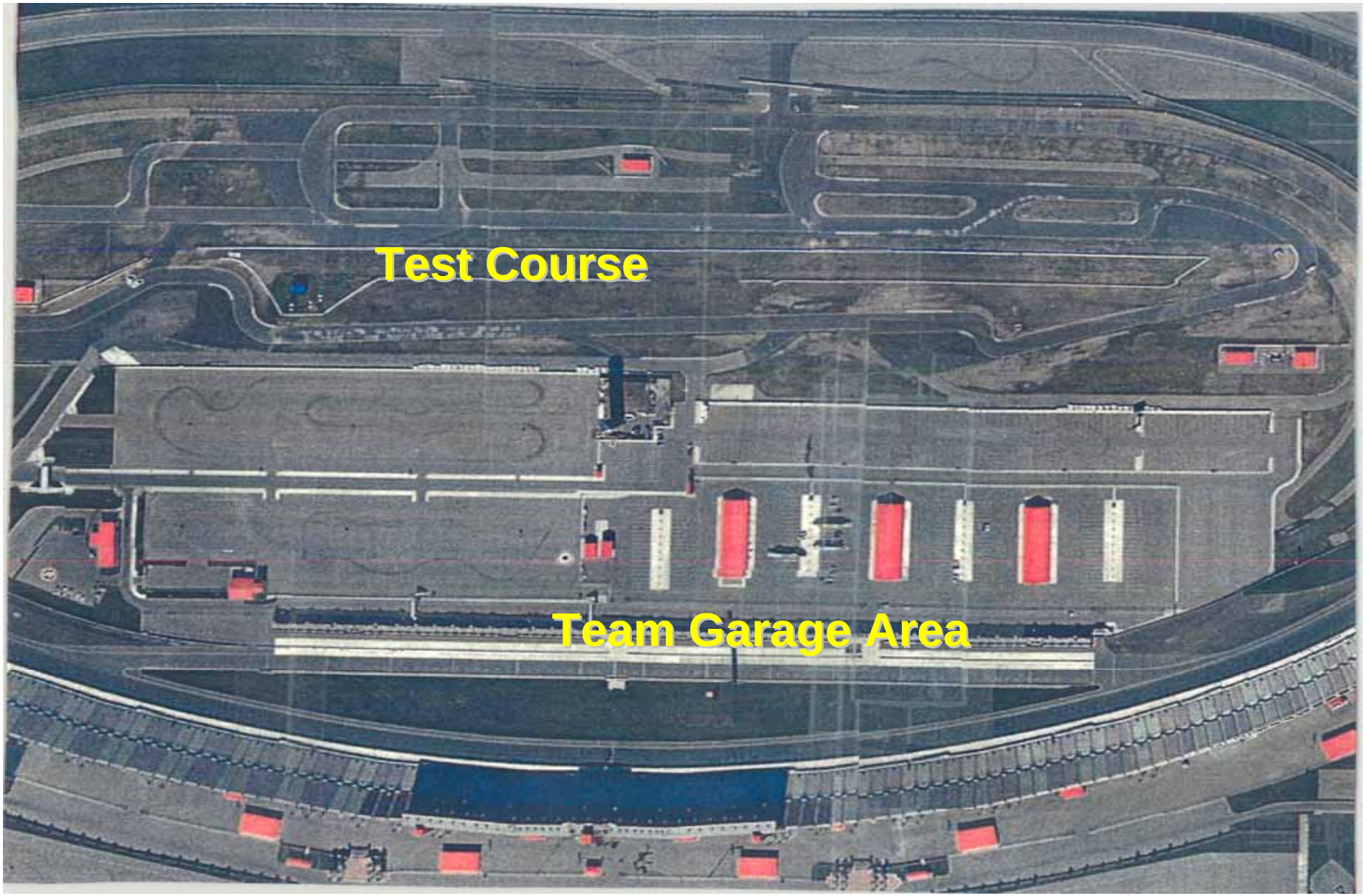


Arrive at California Speedway

Wednesday, September 28

- Vehicle must stay onsite until October 6
- Number of people with access to the garage area is limited

NQE at California Speedway



Team Liaisons

- DARPA rep assigned to each Team
  - Interface to DARPA staff
  - Crew member in chase vehicle
- Teach him how to operate your vehicle
  - Prep for autonomous
  - Restart procedure
  - Towing
  - Manual operation

Semi-Finalist Meeting

Wednesday, September 28

Preparation and Safety Inspections

Wednesday - Thursday, September 28-29

Audio alarms

Warning lights

E-Stop

Safety Equipment

Team ID Number

Opening Ceremony

Thursday, September 29

NQE Demonstration Course

Thursday, September 29 – Wednesday, October 5

Each vehicle will get at least 2 runs

Practice areas

Available all week

NQE Start Procedure

- E-stop check in staging area
- 5 minutes to enable autonomous operation

NQE Test Course

Simulate major features of the Grand Challenge route

NQE Obstacles

Obstacles may be moved from day to day

Grand Challenge Finalists

Thursday, October 6

- Safety is the primary requirement
- Best 20 performers
- Grand Challenge start order

Transport vehicles to start area

Steps to Success…